

Re: Articulated Concrete Block (ACB) Overtopping Protection

Dear Engineer:

The enclosed guidance document outlines important design parameters to keep in mind during design of ACB overtopping protection. The Bureau's staff will be looking for the design data and documentation described in this document when reviewing a dam safety permit application that proposes the use of ACBs.

It has recently come to our attention that a construction detail that has been used for overtopping designs using open-cell ACBs is likely to be detrimental to the performance of the block during overtopping. The common overtopping detail has been: geotextile on the subgrade, followed by a stone drainage layer, followed by an additional layer of geotextile, then the block and sometimes topsoil/seed. Based on recent hydraulic testing, it appears that the geotextile between the block and the stone drainage layer may not be adequately permeable, resulting in excessive uplift forces on the block.

For this reason, we will not be allowing geotextile between the block and the stone layer until such time that ACB manufacturers can demonstrate that use of the geotextile is appropriate. Use of a geogrid at that location may be acceptable, or even desirable, to prevent loss of drainage stone through the block openings; however, we are awaiting additional information on that issue. It should be further noted that topsoiling and seeding the block may not be possible without the geotextile because the topsoil has the potential to clog the stone drainage layer which is critical to performance of the block.

If you have project specific questions, please contact your project manager at the Bureau. For general questions regarding this letter, please contact Darin Shaffer at (609) 984-0859.

Sincerely,

John H. Moyle, P.E., Manager
Bureau of Dam Safety & Flood Control

**Submittal and Review Requirements for Overtopping Protection
Utilizing Articulated Concrete Blocks (ACBs)
For
NJDEP- Bureau of Dam Safety & Flood Control**

The following guidelines are developed based on the information available at this time. As this technology develops, changes to the guides will follow. The Bureau will remain open to new technologies as long as the applicant can demonstrate that a proposal has been properly designed and tested and that the material properties can provide long term, low maintenance performance.

1. Engineers must provide supporting documentation that the block which is being specified has been properly flume tested to verify it's acceptable limits, unless the Bureau already has said documentation.
2. ACBs may be installed for overtopping protection only where there is straight, uniform flow similar to the flows used to test the block's performance. ACBs should not be installed where flow turbulence is expected such as along angled embankment groins, or in the vicinity of structures or obstacles that re-direct or impede the flow.
3. The potential hydraulic jump location(s) must be analyzed. If a hydraulic jump is expected to occur over the ACBs (on the slope or apron), the forces associated with the jump must be analyzed in accordance with the manufacturer's guidance. The manufacturer's guidance must be based on appropriate hydraulic test data. If such data is unavailable or is inconclusive, other erosion protection measures may be needed.
4. Computations of the velocities and shear stresses on the downstream slope must be submitted. A safety factor against overturning of at least 1.5 must be achieved using the manufacturer's stability analysis. It is likely that a higher safety factor is warranted for overtopping applications at high and significant hazard dams.
5. If computed peak velocities over the ACBs are approximately 25 fps or higher, further review by the manufacturer and the Bureau will be required. At velocities above 25 fps, one or more of the assumptions used in the stability analysis may not be valid.
6. If tapered blocks are specified, 0" of assumed projection is acceptable for the stability analysis. If regular (non-tapered) blocks are specified, the analysis must assume a minimum ½" projection.

7. Use of ACBs along the side-slope of a channel that is part of an overtopping application may require a separate analysis for the side-slope because of the different angles involved in the analysis.
8. ACBs must be cabled and all ACB system details must be essentially the same as the details which were utilized in the testing procedures (i.e. drainage layers, filters, cables, etc.). Details such as mat terminations must be in accordance with the manufacturer's guidance.
9. Use of a geotextile layer between the ACB and any required drainage layer will not be permitted unless it can be demonstrated that the proposed design meets required safety factors. Topsoiling over ACBs may not be permitted unless it can be demonstrated that the topsoil will not clog any drainage layer necessary to meet the required hydraulic performance.
10. Specifications must identify the block and manufacturer that was analyzed in the design report. If the design engineer determines that an "approved equal" is permissible, the specification must further require that any proposed change in block or manufacturer will require a new design analysis that must be submitted to this Bureau for review/approval as a modification to the permit, prior to construction.
11. Specifications for ACBs must include a requirement for freeze/thaw durability testing and must specify the required ASTM test, the minimum number of freeze/thaw test cycles as well as the corresponding weight loss criterion for a pass-fail determination.

The Bureau may, on a case by case basis, require additional information.